

A HISTORY OF AI

Zaid Harchaoui

COUNTDOWN TO THE RISE OF AN ARTIFICIAL INTELLIGENCE?

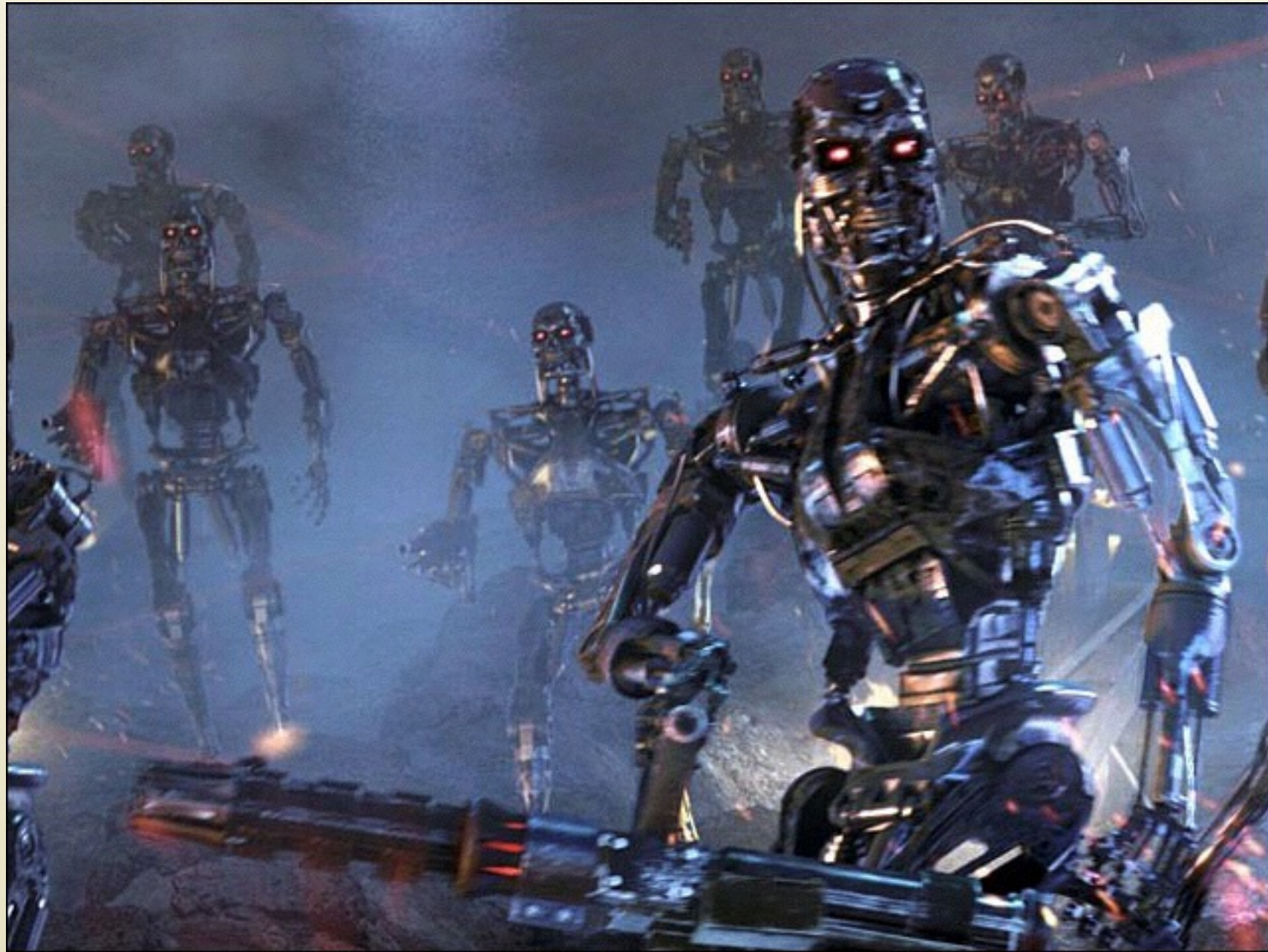


PERCEPTION OF AI



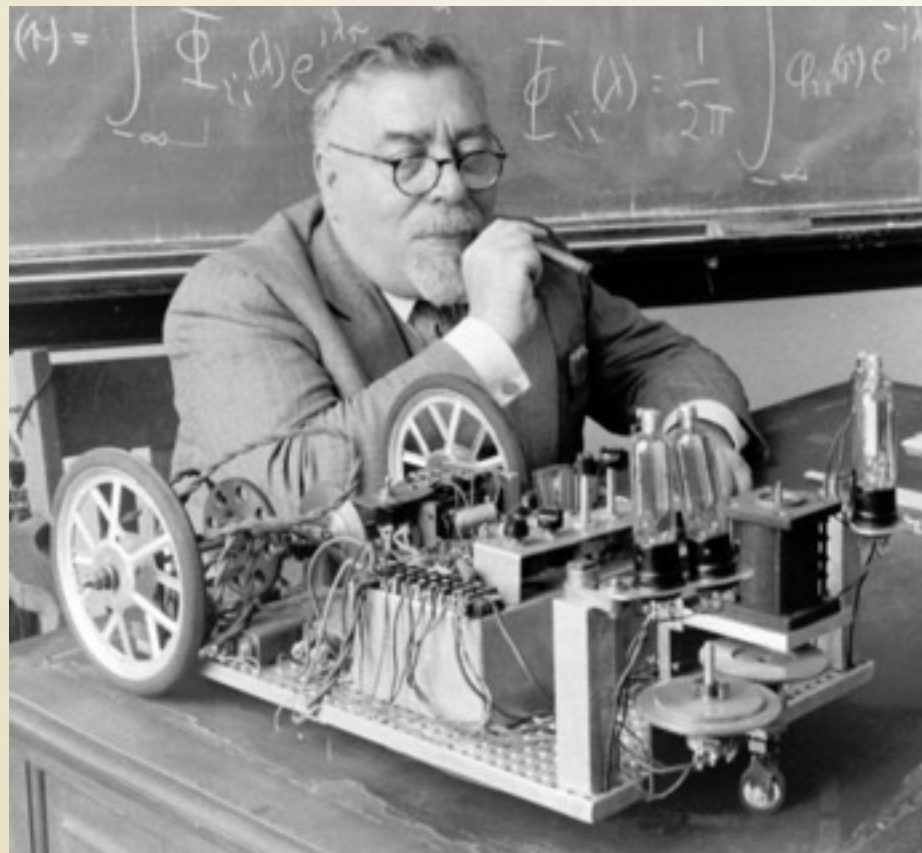
The Mecha *David* in "A. I. Artificial Intelligence" (Spielberg, 2001)

PERCEPTION OF AI

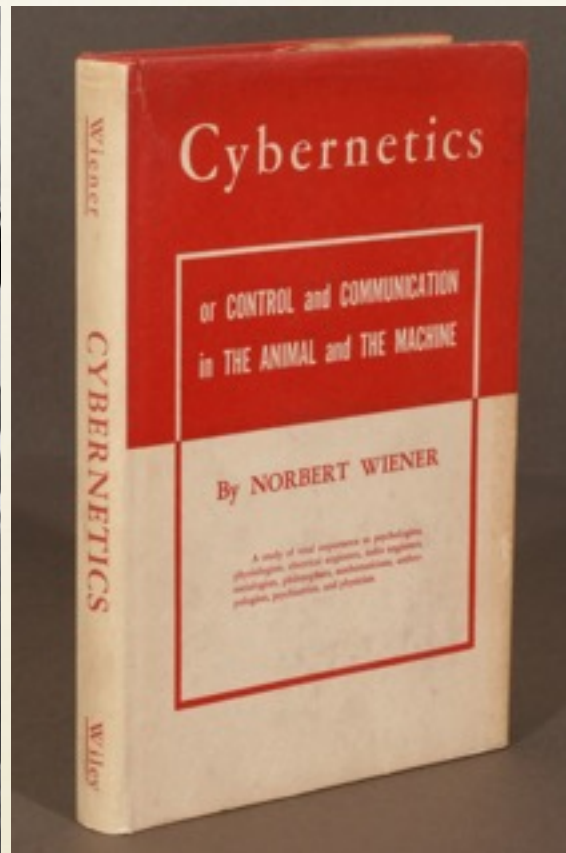


Terminators after the rise of Skynet "Terminator III" (Mostow, 2003)

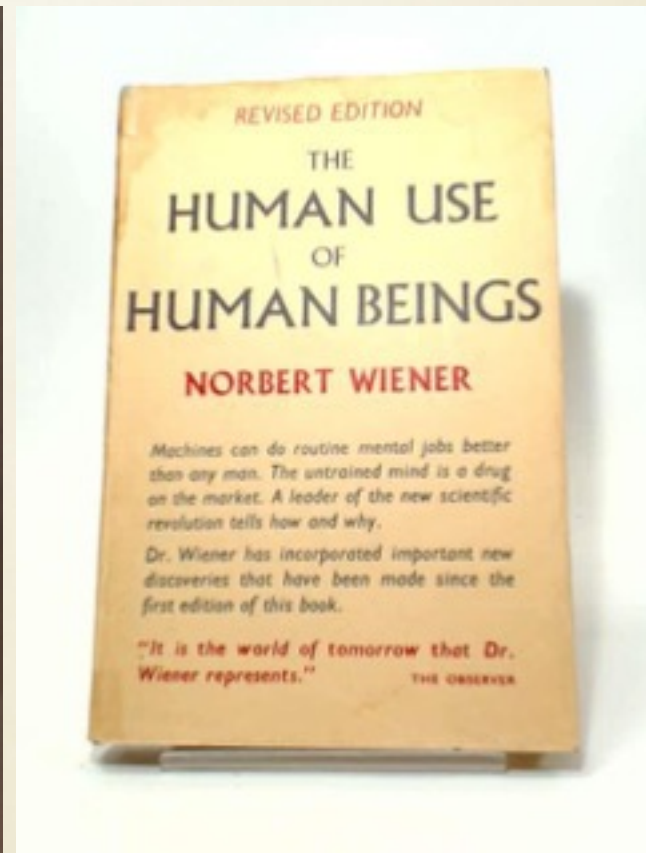
CYBERNETICS



Norbert Wiener, 1894-1964



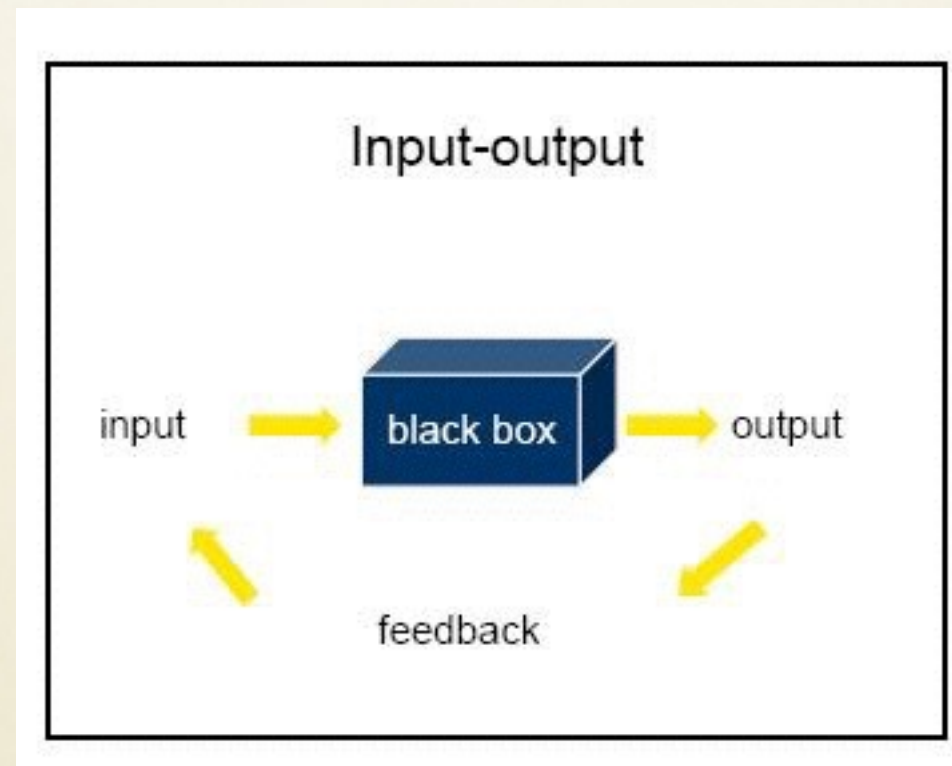
1947



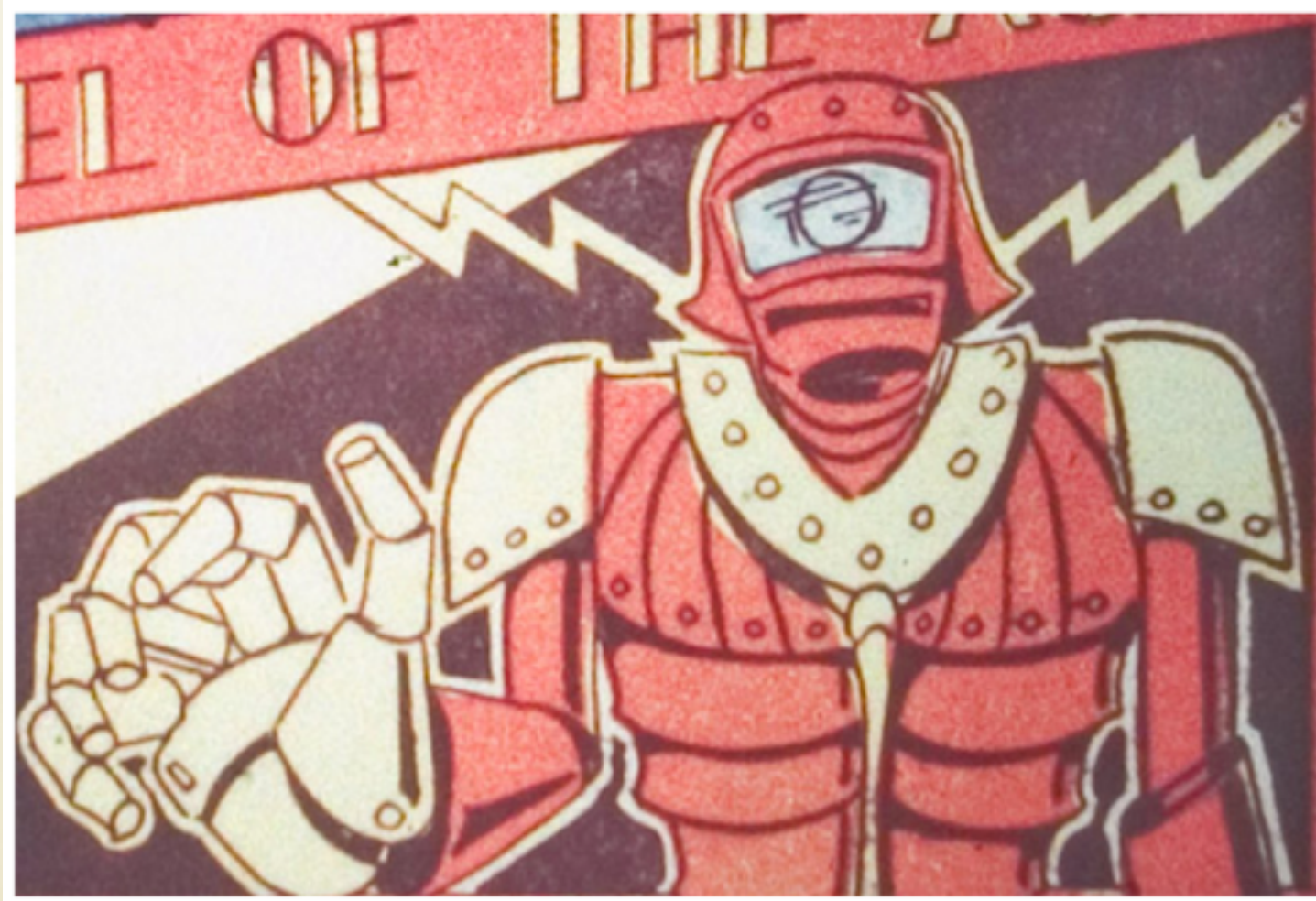
1950

CYBERNETICS

NON-LINEAR SYSTEMS



MACHINES IN POP CULTURE, 1940-1950



Electro, crime-fighting robot (Marvel, 1940)

WIENER'S VISION

Wiener's insights

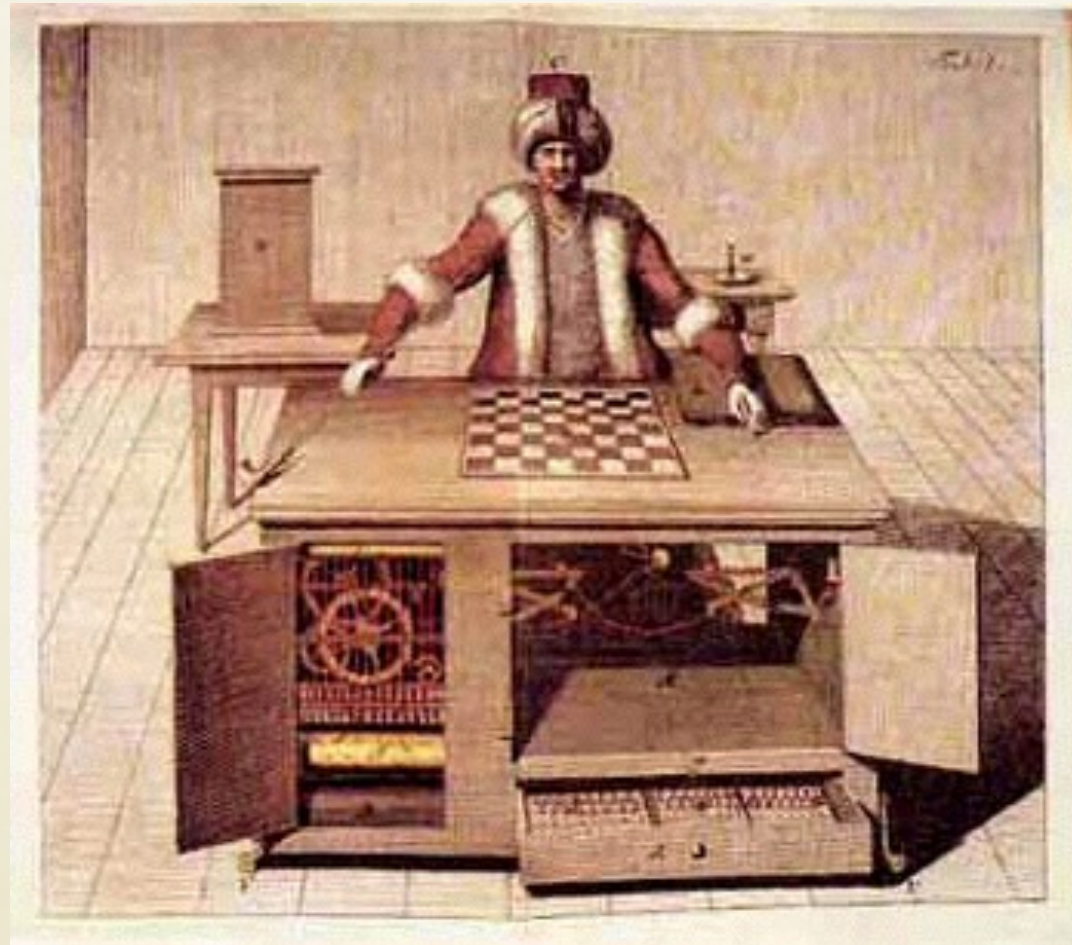
1. problem-solving machines
2. machines making machines
3. acceleration of progress in making machines

WIENER'S VISION

Wiener's insights

1. **problem-solving machines**
2. machines making machines
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SOLVING PROBLEMS WITH MACHINES



Mechanical Turk chess-playing automaton, circa 1770

FATHERS OF AI

Dartmouth Conference: The Founding Fathers of AI



John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff

Alan Newell



Herbert Simon



Arthur Samuel



And three others...

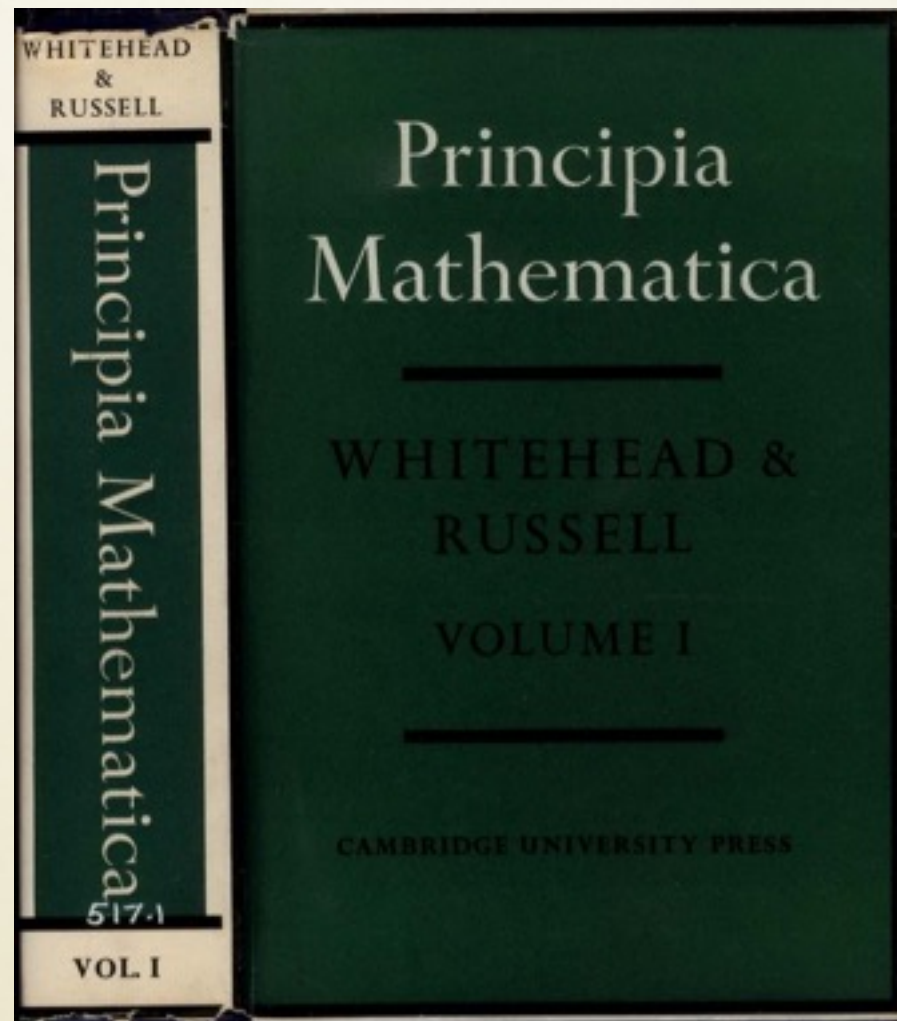
Oliver Selfridge
(Pandemonium theory)

Nathaniel Rochester
(IBM, designed 701)

Trenchard More
(Natural Deduction)

Dartmouth Summer Research Project on Artificial Intelligence (1956)

THE LOGIC THEORIST



THE LOGIC THEORIST



GENERAL PROBLEM SOLVER

Computer program that solves any problem that can be expressed with well-formed formulas (Horn Clauses)

- Towers of Hanoi
- Euclidean Geometry

SOLVING PROBLEMS WITH MACHINES



Stalin vs Truman

SOLVING PROBLEMS WITH MACHINES

FRIDAY, FEBRUARY 17, 1978
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The New York Times

Computer Gains on Chess Master

By MALCOLM W. BROWNE

In 1968, David Levy, a British international chess master, bet a group of computer experts 1,250 pounds that in the decade that followed no chess-playing computer could beat him. This year, Mr. Levy expects to collect his wager, but it is turning out to be a much closer race than many had imagined possible.

Chess-playing skill is widely regarded as a legitimate gauge of at least one aspect of human intelligence. Most human chess masters had long believed that although computers could rapidly sift through an enormous number of possibilities, machines lacked certain qualities vital to real mastery of the game.

But new computer programs are proving to be such formidable opponents in tournament play, experts say, that old ideas about the limitations of computer intelligence must be revised.

Levy vs. Chess 5.0

The man-versus-machine controversy this year will center on two conspicuous antagonists.

One is Mr. Levy, a 32-year old Londoner who writes chess books and is classified as a "weak" international master—one of the few hundred best chess players in the world.

Opposing him will be a computer program called "Chess 5.0" devised by David J. Slate, a 33-year-old computer expert of Northwestern University, in Evanston, Ill. Mr. Slate's program, as used on a powerful Control Data Corporation Cyber 176 computer, is also among the several hundred best chess players in the world.

In separate interviews, Mr. Slate and Mr. Levy agreed that Mr. Levy would probably beat the computer in a final match, which may be played in August at the Canadian National Exposition in Toronto.

If so, Mr. Levy will win 1,250 pounds (about \$2,400) from four professors in computer technology—Donald Michie of Edinburgh University, Seymour Papert of Massachusetts Institute of Technology, John McCarthy of Stanford University, and Edward Knudowski of Princeton University. He also hopes to receive large royalties from television coverage.

Referring to the Northwestern computer group Mr. Levy said: "Unless they make some major improvements in their Chess 4.6 program, my chances are good. They don't have to get much better to beat me, and they've already beaten me in speed matches, five seconds a move. But they're running out of time."

Mr. Slate said: "Using our present Chess 4.6 program, I'll be very happy if we take one and a half or two games out of eight from Levy. If our new Chess 5.0 program proves to work and be as adaptable as we hope, we could really put a dent in Levy."

The Chess 4.6 program has already shaken the chess community to some extent.

In 1976, the Paul Masson Chess Tournament in California attracted some 700 contestants, including Mr. Slate's program, which was entered in the Class B level against 128 good amateur players. The computer easily won all its games to take a \$750 prize, which Northwestern had agreed in advance to relinquish.

In February 1977, Chess 4.6 entered the Minnesota Open Tournament, playing against some highly ranked opponents.

Chess 4.6 won the tournament 5 to 1, emerging with an official rating of 2,271—a chess master.

Defeated Soviet Program

The Chess 4.6 program is probably the best in the world. Last year it easily defeated the Soviet "Kaissa" program in Toronto, 4 to 0.

Mr. Levy and Mr. Slate agree that eventually computer programs will successfully challenge even grand masters. Protecting friendly pieces and attacking opposing pieces are the main objects of the computer program, he said, and the program is weak in planning long-range strategy and subtle positional advantages.

Defeating champion computer chess programs, difficult as it is, is vastly simpler than other problems facing experts in artificial intelligence, Mr. Slate and other experts said.

The single biggest problem now is in giving computers natural language ability—the ability to converse with untrained humans in human language.

Retrieving Information

Grouping computer memory data in terms of "frames"—associative scenarios such as "ordering a meal at a restaurant" or "participating in a fertility rite"—is one of the new techniques computer experts are particularly enthusiastic about.

"Framed information will be vastly easier to retrieve, they say, and will be available in forms much closer to human associative recall.

While computer scientists are deeply divided over the question of whether there can be real artificial intelligence, most of those interviewed agreed that the so-called Turing test could eventually settle the argument.

The test is named for the late English mathematician Alan Mathison Turing, who proposed it in the late 1940's. In the test, a human is seated at a telecommunications keyboard, which he uses to converse for a half hour with a computer. He may ask any question, except such purely anthropomorphic questions as "What color are your eyes?"

If after the session the human is unable to decide whether his interlocutor is human or machine, the machine may be said to have human intelligence, according to the test.

One leading computer expert, Dr. Hans Berliner of Carnegie-Mellon University, asserts that such a machine already partly exists in the form of the "Chess 4.6" program.

"Most chess players are defeated by the machine and very, very few players would risk money betting whether they had been beaten by a human or a machine in this case," he said.



Herbert Biensack, regional coordinator of the Bureau of Labor Statistics

Busy Biensack Notes Big

By Carol...

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David Levy vs Chess 4.6, 1978

SOLVING PROBLEMS WITH MACHINES



Boris chess-player, 1979

SOLVING PROBLEMS WITH MACHINES



Boris chess-player, 1980s

SOLVING PROBLEMS WITH MACHINES

Fantasies

- diplomacy
- generic sequential decision-making
- *machine à gouverner*

SOLVING PROBLEMS WITH MACHINES

Problems

- general problems (1959)
- chess-playing
- automatic translation
- computer vision

CHESS-PLAYING MACHINE



DeepBlue, IBM

IBM MACHINE TRANSLATOR



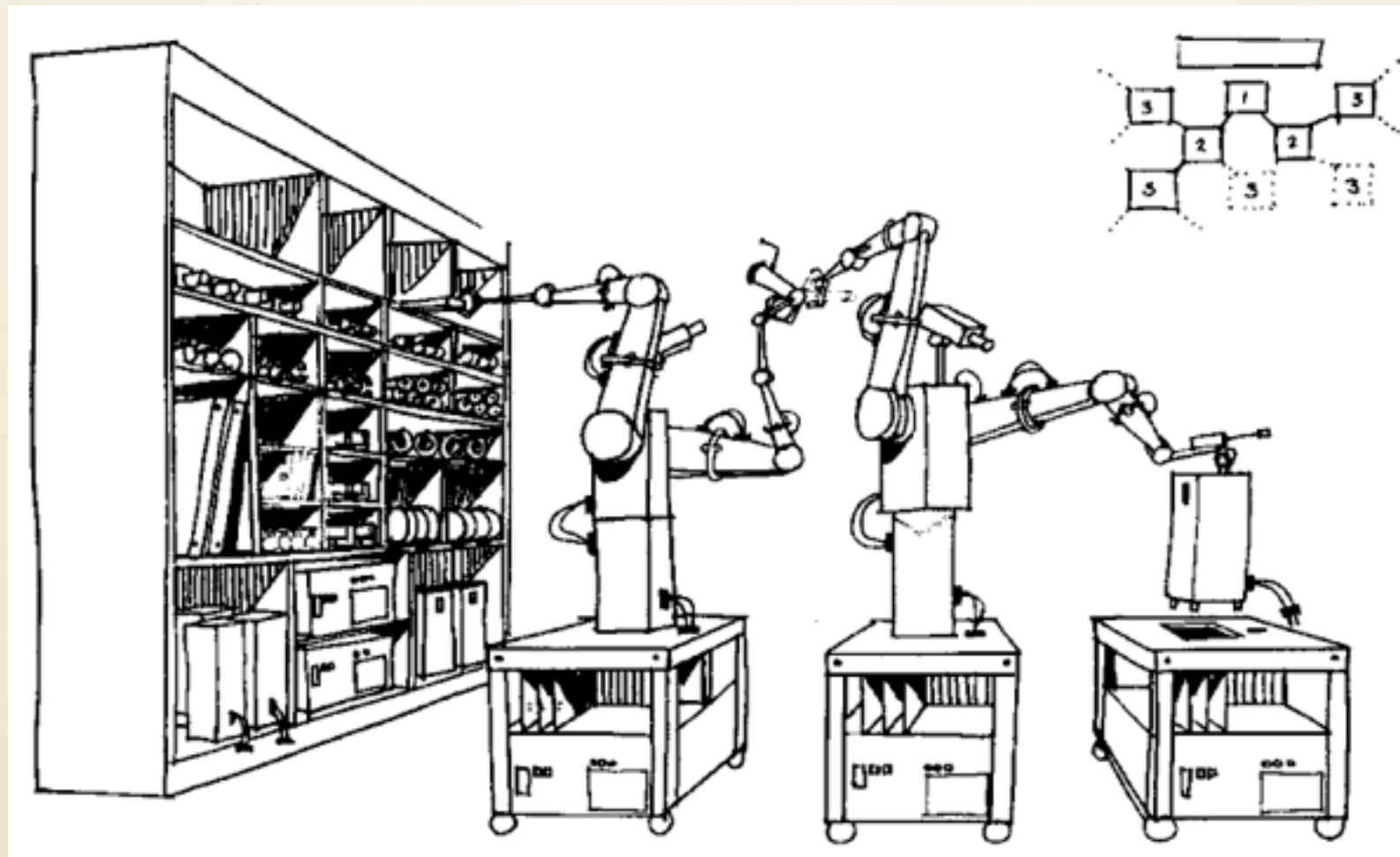
IBM Machine Translator, 1964

WIENER'S VISION

Wiener's insights

1. problem-solving machines
- 2. machines making machines**
3. acceleration of progress in making machines

MACHINES MAKING MACHINES



Self-reproducing machines

SELF-IMPROVING MACHINES



SELF-IMPROVING MACHINES



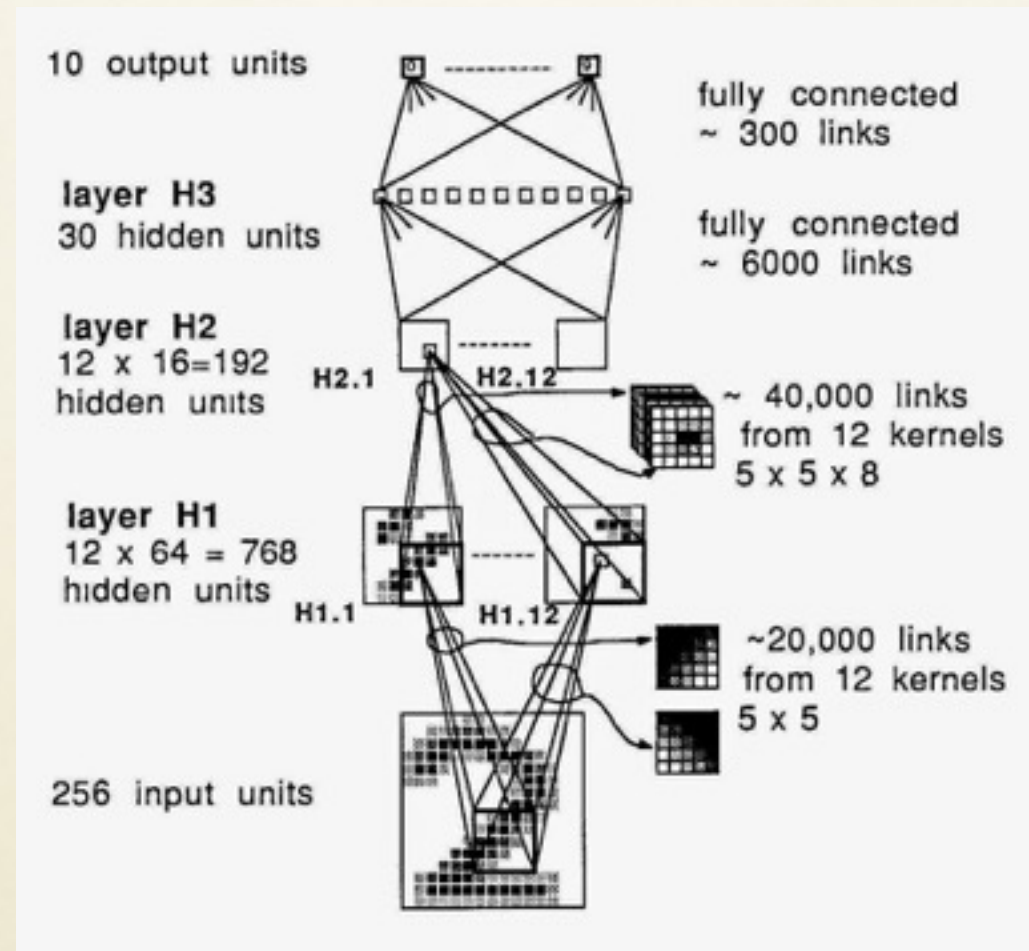
Jet-Jaguar defeating Gigan
"Godzilla vs Megalon" (Fukuda, 1972)

SELF-IMPROVING MACHINES



Jet-Jaguar and Godzilla greetings,
"Godzilla vs Megalon" (Fukuda, 1972)

MACHINE LEARNING



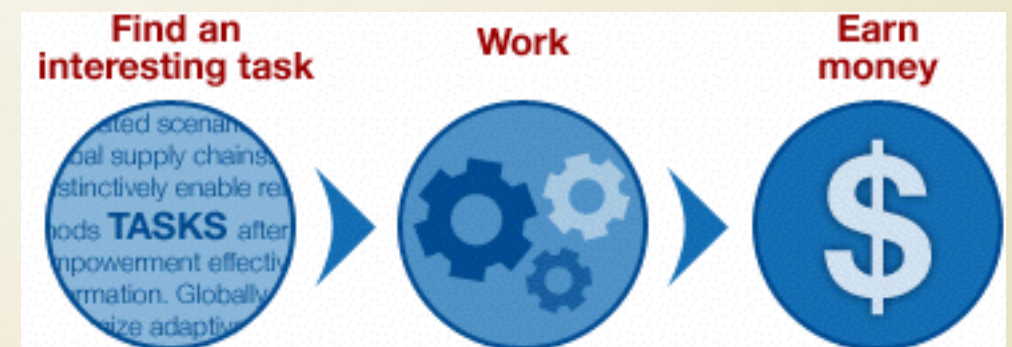
LeNet neural network for digit recognition (LeCun, 1989)

WIENER'S VISION

Wiener's insights

1. problem-solving machines
2. machines making machines
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DATA



AMT

Collecting data through social computing and crowdsourcing

LARGE DATASETS

Hierarchy of classes:



Deng, Dong, Socher, Li, Li and Fei-Fei, "Imagenet: a large-scale hierarchical image database", CVPR'09.

Fine-grained subsets: generally more practical problems



→ Vehicle: 262 classes, 226K images

ImageNet Image Classification Dataset

ACCELERATION OF PROGRESS

Hierarchy of classes:



Deng, Dong, Socher, Li, Li and Fei-Fei, "Imagenet: a large-scale hierarchical image database", CVPR'09.

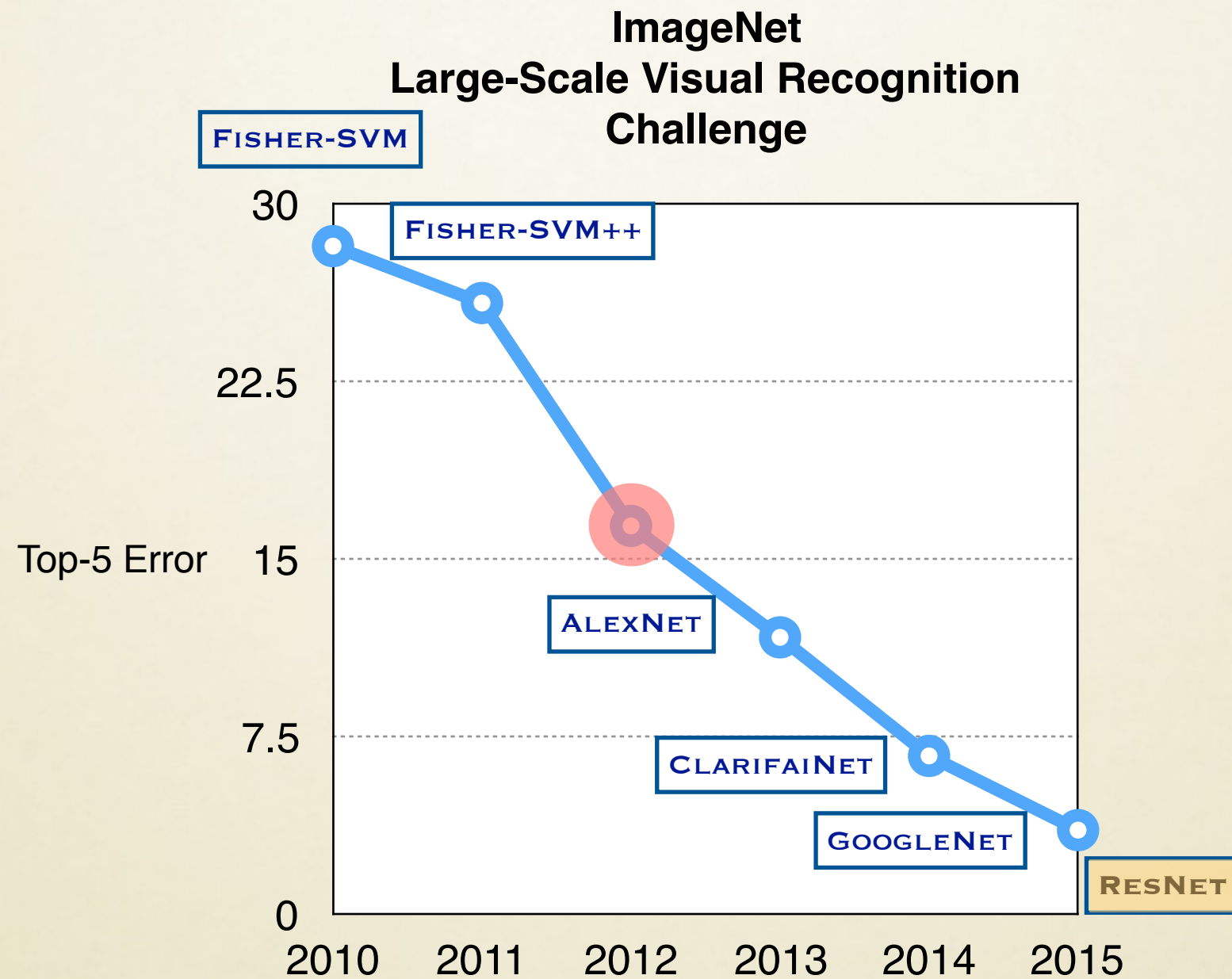
Fine-grained subsets: generally more practical problems



→ Vehicle: 262 classes, 226K images

ImageNet Image Classification Dataset

ACCELERATION OF PROGRESS



Deep Convolutional Neural Nets



AI SCIENTISTS AS ROCK-STARS

Rolling Stone MUSIC POLITICS TV MOVIES CULTURE SPORTS REVIEWS



Facebook's Yann Lecun is an AI pioneer. Denis ALLARD/REA/Redux

LeCun won't say how much money Facebook has invested in AI, but it's recognized as one of the most ambitious labs in Silicon Valley. "Most of our AI research is focused on understanding the meaning of what people share," Zuckerberg wrote during a Q&A on his website. "For example, if you take a photo that has a friend in it, then we should make sure that friend sees it. If you take a photo of a dog or write a post about politics, we should understand that so we can show that post and help you connect to people who like dogs and politics. In order to do this really well, our goal is to build AI systems that are better than humans at our primary senses: vision,

AI and Yann LeCun in Rolling Stone magazine

ACCELERATION OF PROGRESS

Strategy

- gather the most talented people
- give unprecedented amount of resources
- focus on particular challenging problems
- **anticipate the outcomes of the technology**

FUTURE OF AI SYMPOSIUM



<http://cds.nyu.edu/ai/>

CHALLENGES OF AI PROGRESS

Potential challenges

- Scientific: safety, control
- Economic: jobs, employment
- Societal: personal assistants, education
- Ethical: values and norms for robots